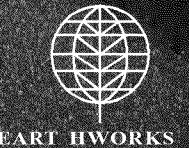




U.S. Copper Porphyry Mines Report

THE TRACK RECORD OF WATER
QUALITY IMPACTS RESULTING FROM
PIPELINE SPILLS, TAILINGS FAILURES
AND WATER COLLECTION AND
TREATMENT FAILURES.

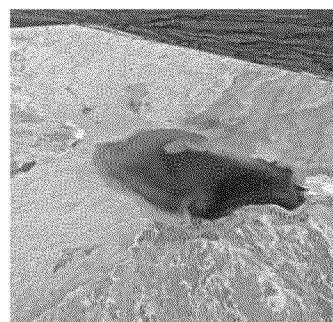
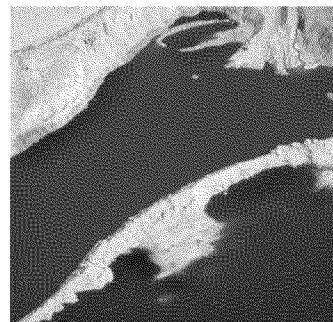
JULY 2012



U.S. COPPER PORPHYRY MINES:

The track record of water quality impacts resulting from pipeline spills, tailings failures and water collection and treatment failures.

EARTHWORKS, July 2012



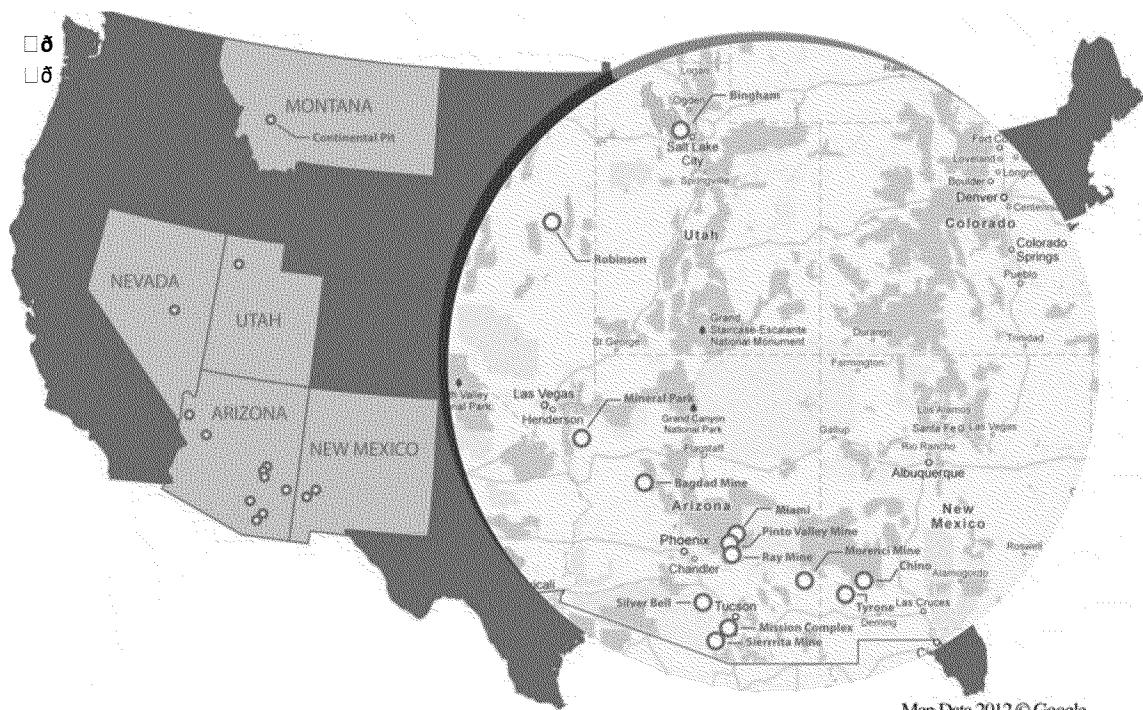
Photos, top to bottom:

Yankee Doodle tailings pond by Ecoflight
Chino Mine by Gila Resource Information Project (GRIP)
Sierrita Mine by Ecoflight
Bird fatality at Tyrone Mine by Jim Kuipers



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EXECUTIVE SUMMARY:

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The Pebble Mine is proposed for development at the headwaters of the Bristol Bay watershed in southwest Alaska, which supports the world's largest wild sockeye salmon fishery.

According to current ore estimates, the Pebble Mine would be the largest copper porphyry mine in the U.S., if constructed.

□δ

Copper porphyry is a form of copper deposit that is often characterized as low-grade, and often containing other minerals such as gold and molybdenum. Copper porphyry deposits are almost all mined in industrial-scale open pit operations.

Currently, the U.S. Environmental Protection Agency (EPA) is completing a watershed assessment to evaluate the potential impacts of large-scale mining on water quality and fishery resources using a mine scenario that reflects the expected characteristics of mining operations at the Pebble deposit.

□δ

We reviewed state and federal documents for fourteen U.S. operating copper porphyry mines to assess the impacts associated with pipeline spills, tailings impoundment failures and water capture and treatment failures.

Our research shows that copper porphyry mines are often associated with water pollution resulting from acid mine drainage and/or metals leaching. Drainage from porphyry deposits commonly have concentrations of aluminum, cadmium, copper, iron, manganese, lead, and zinc that exceed US drinking-water limits to protect public health, and aquatic life standards are also commonly exceeded for cadmium, copper, lead and zinc.¹

We reviewed state and federal documents and a federal database for fourteen copper porphyry mines representing 87% (14 out of 16) of currently operating copper porphyry mines, and 89% of U.S. copper production in 2010 – the most recent data on copper production available from the U.S. Geological Survey. The fourteen mines were chosen based on an operating record of more than five years. These mines provide a representative view of the types of environmental impacts resulting from the development of copper porphyry deposits, focusing on pipeline spills, tailings failures and water collection and treatment failures.

We found that all of the mines (100%) experienced pipeline spills or other accidental releases. The most frequent spills were reported at the Ray Mine in Arizona, where over fifty pipeline spills occurred from 1988 to 2012. Examples of recent pipeline spills include a 2012 spill at the Ray Mine which washed tailings into the Gila River, a 2008 pipeline spill at the Morenci Mine of 186,000 gallons of sulfuric acid along two miles of Chase Creek - a tributary of the San Francisco River, and a 2009 spill of 2 million gallons of process water at the Bagdad Mine.

At 13 of the 14 mines (92%), water collection and treatment systems have failed to control contaminated mine seepage, resulting in significant water quality impacts. The development of acid mine drainage was associated with the most severe and lasting impacts. For example, the Tyrone and Chino mines – the two largest copper porphyry mines in New Mexico, will generate an estimated 2 billion gallons of acid and metals contaminated seepage every year, requiring water treatment in perpetuity. These two mines have resulted in severe surface and groundwater contamination, and the State of New Mexico and U.S. Department of Justice have filed natural resource damage claims against the company for damages to water and wildlife resources.



The Bingham Canyon Mine, the largest copper porphyry mine currently operating in the United States, will also generate water pollution in perpetuity from the mine's waste rock piles. Mine operations have resulted in a plume of contaminated groundwater extending over 70 square miles, and the State of Utah filed a natural resource damage claim against the mine in 2008 for impacts to water and wildlife resources.

□δ

Tailings spills have occurred at nine operations, and a partial failure of the tailings impoundment occurred at four out of fourteen mines (28%). These included a 1997 partial failure of the tailings impoundment at the Pinto Valley Mine, where the creek bed and surrounding upland were buried under material as deep as 42 feet. In 1993, heavy precipitation caused the Gila River to flood and breach the tailings impoundment at the Ray Mine, carrying pollutants 11 miles downriver. And in 1980, 2.6 million cubic yards of tailings were released at the Tyrone mine, and flowed 8 kilometers downstream.

Many of the currently operating copper porphyry mines are located in the arid southwest, where precipitation is limited, and communication between surface and groundwater resources is limited. **More significant impacts could be expected at mines in wetter climates, with abundant surface water and shallow groundwater, such as is the case in the Bristol Bay region.** Research shows that mines with high acid generating potential and in close proximity to surface and groundwater are at highest risk for water quality impacts.²

Additional impacts at these mines, particularly water collection and treatment failures, are likely to occur after mining operations cease and groundwater pumps are no longer keeping the mine area dewatered.

A review of the track record of water quality impacts from copper porphyry mines found severe impacts to drinking water aquifers, contamination of farmland, contamination and loss of fish and wildlife and their habitat, and risks to public health. In some cases, water quality impacts are so severe that acid mine drainage will generate water pollution in perpetuity.

□δ



Table 1
2010 copper production amounts for mines reviewed in this report.

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Mine □	Location □	Company □	2010 Copper □ production □ (Metric Tons) □
Bingham Canyon □	UT □	Kennecott/Rio Tinto	250,000 ³
Morenci □	AZ □	Freeport □	233,146 ⁴
Ray □	AZ □	ASARCO □	105,051 ⁵
Bagdad □	AZ □	Freeport □	92,079 ⁶
Mission □	AZ □	ASARCO □	83,415 ⁷
Sierrita □	AZ □	Freeport □	66,678 ⁸
Robinson □	NV □	Quadra □	49,400 ⁹
Tyrone □	NM □	Freeport □	37,194 ¹⁰
SilverBell □	AZ □	ASARCO □	21,000 ¹¹
Chino □	NM □	Freeport □	15,400 ¹²
Mineral Park □	AZ □	Mercator □	14,605 ¹³
Miami □	AZ □	Freeport □	8,100 ¹⁴
Pinto Valley □	AZ □	BHP □	6,000 ¹⁵
Continental Pit □	MT □	Montana Resources □	Not available
Total production of 15 mines □			982,068
Total U.S. production □			1,100,000
Percent of U.S. production □			89%

□
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Table 2

Synopsis of pipeline spills, tailings spills and impoundment failures, and water capture and treatment failures for 14 copper porphyry mines (1986-2012).

Mine	Number of reported pipelines spills and other accidental releases*	Water collection and treatment failures	Tailings dam failures	Affected surface and/or ground water
Morenci	21	Yes	□	San Francisco River, Gila River, Chase Creek, groundwater aquifer
Bingham Canyon	28	Yes	□	72 square miles of contaminated groundwater; fish and wildlife habitat in Great Salt Lake ecosystem
Ray	54	Yes	Partial	Mineral Creek, Gila River, groundwater aquifer
Chino	10	Yes	□	Hanover/Whitewater Creek, contaminated groundwater will require water treatment in perpetuity
Bagdad	7	Yes	□	Boulder Creek, Burro Creek, Butte Creek, Bridge Creek
Sierrita	18	Yes	□	Demetrie Wash and tributaries; groundwater aquifer including drinking water wells in Green Valley
Pinto Valley	3	Yes	Partial	Pinto Creek
Mission	3	Yes	Partial	Tributaries of Gila River, groundwater aquifer
Robinson	8	Unknown	□	2.3 miles of downstream bed
Tyrone	7	Yes	Partial	Mangas Creek, groundwater contamination will require water treatment in perpetuity
Mineral Park	3	Yes	□	Groundwater aquifer and surface water
Miami	8	Yes	□	Pinal Creek alluvial aquifer
Silver Bell	3	Yes	□	Cocio Wash
Continental Pit	2	Yes	□	Silver Bow Creek, groundwater aquifer

□

*Limitations in data for pipeline spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill.

□



CASE STUDIES:

MORENCI MINE, AZ (Free Morenci)	
<p>The Morenci Mining District is located southeast of Arizona near the towns of Clifton and Morenci. It is located the Gila River, the San Francisco River and Eagle Creek.</p>	
Report of pipeline failures and other accidental releases*	<p>2008: Report of a pipe破裂 causing 186,000 gallons of sulfuric acid and heavy metals into a tributary (Chesee Creek) of the San Francisco River, resulting in a \$10,000 settlement with the state of Arizona. The highly acidic material traveled downstream for about 2 miles. The pollutants in the discharge exceeded Arizona surface water quality standards for copper, zinc and pH. ¹⁶</p> <p>2007: Report of a release of 1,200 gallons of pregnant each solution released due to a power failure. ¹⁷</p> <p>2006: Report of a release of 3,000 pounds of sulfur from pipeline break. ¹⁸</p> <p>2006: Report of 1 pound of material from pipeline. ¹⁹</p> <p>2006: Report of a release of hydrochloric acid (acid content 1,067 pounds) from an underground process pipeline. ²⁰</p> <p>2004: Report of a release of 8,000 pounds of sulfur and water from process pipeline due to a failure of valve. ²¹</p> <p>2001: Report of a release of 350 pounds of sulfur released from pipeline. ²²</p> <p>2000: Report of a release of 7,000 gallons of sulfur released from pipeline. ²³</p> <p>1998: Report of a release of 6,200 pounds of sulfur released from pipeline. ²⁴</p> <p>1996: Report of a release of unknown amount of pregnant each solution spilled from pipeline, affecting Chesee Creek, leading to the San Francisco River. At the time of the report, gpm were being released. ²⁵</p> <p>1996: Report of a release of 150 gallons of process solution spilled due to a pipe break. ²⁶</p> <p>1996: Report of a release of 50,000 pounds of sulfuric acid spilled from backitting the pipeline. ²⁷</p> <p>1996: Report of 12,435 pounds of sulfur released from pipeline. ²⁸</p> <p>1995: Report of 2,080 pounds of sulfur released from pipeline. ²⁹</p> <p>1994: Report of 203,400 tons of raffinate released due to a ruptured pipe. ³⁰</p> <p>1994: Report of 5,400 pounds of sulfur released due to a fracture in the pipeline. ³¹</p> <p>1993: Report of unknown amount of copper released into San Francisco River due to a storm. ³²</p> <p>1993: Report of 180,000 gallons of pregnant each solution spilled due to a plug in the line, affecting acre. ³³</p> <p>1992: Report of 250 tons of electrolyte released. ³⁴</p> <p>1992: Report of 15,000 tons of copper released due to a failure. ³⁵</p> <p>1992: Report of 750 tons of electrolyte due to a failure of the pipeline. ³⁶</p>
Water collection and treatment failures	<p>In 2012, State of Arizona Justice Department found that, "mine tailings exposed to atmospheric precipitation released hazardous substances on the surface of the tailings or the ground through the tailings to the groundwater." The consent decree found that, "releases of the hazardous substances at the Morenci mines have occurred and that such releases have caused injury to natural resources."</p>



	<p>resources at risk and viability of critical mining surface water, sediments, soil, and terrestrial habitats and terrestrial receptors.”³⁷ A final financial settlement followed an investigation of natural resource injuries related to release of hazardous substances into the environment from acid mine drainage and process solution, among other sources. The investigation found that the main ore minerals are sulfide minerals, which have resulted in development of brine drainage. According to the “Surface water has been, and most likely continues to be exposed to hazardous substances released from the Morenci Mine through a variety of pathways.”³⁸ Concentrations of hazardous substances measured in the groundwater at Morenci Mine were measured in the San Francisco and Gila Rivers downstream of the mine provide further indications that hazardous substances present in the ore minerals at the Morenci Mine have been released to the environment. Certainty that “Concentrations of total dissolved zincha exceeded 1,000 ug/l in the Gila River, a concentration of the dissolved metal exceeded 100 ug/l in the San Francisco River.”³⁹ Contaminated groundwater is also released to the surface via seeps and springs.⁴⁰</p>
Tailing spills and impoundment failures	No impoundment failures
Impacts to water, fish and wildlife	<p>In 2012, USGS and the Department of Interior jointly announced that Freeport-McMoRan had agreed to pay \$8 million to the federal and state natural resource damages related to the Morenci Mine. According to the plan, the hazardous substance release, which included sulfuric acid and metals, injured, destroyed or killed the loss of “surface, terrestrial habitat and wildlife, and migratory birds.”⁴¹</p> <p>As described, metals contamination occurred in the San Francisco and Gila Rivers downstream of the mine, and to the groundwater supplies.</p>

*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill.



□ δ
BINGHAM CANYON MINE and SMELTER , (KUHNecott) □ δ

The Bingham Canyon Mine is the deepest open pit mine in the world, located southwest of Salt Lake City, Utah. □ δ

Report of pipeline failures and other accidental releases* □ δ	2011: Report of malfunction of equipment allowed the release of approximately 145,424 gallons of copper tailings. ⁴² □ δ 2011: Report of pipeline overflow resulting in estimated 100,000 to 290,000 gallons of copper tailings material released from pipeline. ⁴³ □ δ 2011: Report of tailings slurry released from tailings storage holding tank 160,000 gallons of tailings released. ⁴⁴ □ δ 2010: Report of release of process water due to broken pipeline. □ δ 2010: Report of discharge of sulfuric acid from a pipeline to a metal plant released between 4,000 - 5,000 gallons. ⁴⁵ □ δ 2007: Report of release of 35 gallons of hydrazine containing arsenic due to pipeline break. ⁴⁶ □ δ 2007: Report of 1,040,000 gallons of process water containing arsenic from pipeline break due to temperatures. ⁴⁷ □ δ 2006: Report of 270,000 gallons of process water released because of rupture, which resulted in overflow containment. ⁴⁸ □ δ 2006: Report of 1,000,000 gallons of process water containing arsenic released due to cracked pipe. ⁴⁹ □ δ 2006: Report of 1,000,000 gallons of process water released from the Magna Reservoir due to failed indicator. ⁵⁰ □ δ 2004: Report of 1,000,000 gallons of process water containing arsenic from pipeline. ⁵¹ □ δ 2004: Report of 1,000,000 gallons of process water containing arsenic from broken process waterline. ⁵² □ δ 2004: Report of 200,000 gallons of process water released due to broken pipeline. ⁵³ □ δ 2003: Report of 70,000 gallons of process water containing arsenic released due to pipeline failure. ⁵⁴ □ δ 2003: Report of 700,000 gallons of process water released from pipeline. ⁵⁵ □ δ 2003: Release of copper concentrate, containing 340 pounds of arsenic, 200 pounds of copper, and 200 pounds of lead. ⁵⁶ □ δ 2003: Copper concentrate pipeline ruptured, releasing 240,000 tons of copper and 120 tons of lead. ⁵⁷ □ δ 2002: Report of 1,800 gallons of process water from slag pot flooding area due to a plugged drain line. ⁵⁸ □ δ 2001: Report of tailings pipeline failure, releasing pounds of arsenic, pounds of chromium and 100 pounds of lead. ⁵⁹ □ δ 2000: Report of 100 tons of slurry released due to broken pipeline. ⁶⁰ □ δ 2000: Report of 15,000 tons of sulfur released from pipeline due to flange. ⁶¹ □ δ 1999: The process water pipeline sprung a series of leaks in 1989 and 1999. It is estimated that 100 million gallons of process water with high arsenic levels spilled before the leak was discovered. ⁶² □ δ
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	<p>1998: Report of copper sulfate released into the canal. □⁶²</p> <p>1998: Report of the clogging system causing pipe backups and flow releasing acid into rock drainage into water. □⁶³</p> <p>1997: Report of the seeping over flow due to the clogged valve. Release of the copper sulfate into water. □⁶⁴</p> <p>1997: Report of the pipeline leaking process water (pH 2.5) into water. □⁶⁵</p> <p>1993: Report of the 4500 tons of the wastewater spilled due to the rupture of the transfer line.⁶³ □⁶⁶</p> <p>1991: Report of 30,000 gallons of the industrial water spilled at the wastewater treatment plant due to the break. □⁶⁴ □⁶⁷</p>
Water collection & treatment failure	<p>2011: Non-compliance in April 2011 for discharges of the copper and total suspended solids at the copperelter.⁶⁵ □⁶⁸</p> <p>Wastewater from the mine has escaped the wastewater collection system, contaminating groundwater with acid, metals and sulfates. The groundwater plume extends towards the nearby Jordan River and covers more than 720 square miles – rendering water for thousands of Las Vegas residents undrinkable.⁶⁶ There have been multiple tailings spills.⁶⁷ □⁶⁹</p> <p>Drainage from the wastewater piles will require water treatment to perpetuate to prevent additional groundwater pollution.⁶⁸ □⁷⁰</p> <p>In February 2008, the United States Fish and Wildlife Service took legal action against Kennecott for the release of the hazardous substances from the mine's facilities, including selenium, copper, arsenic, lead, zinc and cadmium.⁶⁹ Groundwater contaminated by the mining operations has been released from the mine site through artesian springs into areas that serve as fish and wildlife habitats. According to the biologists, the release of the hazardous pollutants has harmed natural resources, including migratory birds and other support ecosystems, which includes wetlands, marshes, freshwater wildlife habitats, playas and riparian areas and freshwater ponds.⁷⁰ □⁷¹</p>
Impacts to water, fish and wildlife.	<p>In February 2008, the United States Fish and Wildlife Service took legal action against Kennecott for the release of the hazardous substances from the mine's facilities, including selenium, copper, arsenic, lead, zinc and cadmium.⁷¹ Groundwater contaminated by the mining operations has been released from the mine site through artesian springs into areas that serve as fish and wildlife habitats. According to the biologists, the release of the hazardous pollutants has harmed natural resources, including migratory birds and other support ecosystems, which includes wetlands, marshes, freshwater wildlife habitats, playas and riparian areas and freshwater ponds. □⁷²</p>

*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill. □⁶⁸ □⁶⁹



<p style="text-align: center;">RAYMINE and HAYDEN Smelter , (ASARCO) 72</p> <p>The Ray Mine is a copper mining facility of approximately 1,100 acres near Kelvin, Arizona 73 which discharges into Mineral Creek, a tributary to the Gila River, and the Hayden Facility is smelting facility located in Arizona along the Gila River. 74</p>	
<p>Report of pipeline failures and other accidental releases* 75</p> <p>2012: Potable waterline ruptured, which washed tailings into the Gila River. 76</p> <p>2007: A broken coupling on a pipeline spilled tailings onto the banks and into the Gila River. A \$20,000 penalty was paid. 77</p> <p>2007: Report of 3,000 pounds of sulfur spilled from pipeline. 78</p> <p>2006: Report of 60,000 pounds of sulfur spilled due to a piping break inside of a mine. 79</p> <p>2000: Report of 8095 pounds of copper released from basin/dam into Mineral Creek. 80</p> <p>2000: Report of 17,000 pounds of copper spilled from pipe. 81</p> <p>1999: Report of 33,000 gallons of tailwater released from pipeline. 82</p> <p>Between August 1998 and November 1998, 47 separate releases of hazardous substances into Mineral Creek from the Ray Mine were reported. 83</p> <p>According to a ecological risk assessment prepared by the state of Arizona, a large portion of these releases were uncontaminated and eventually entered Mineral Creek and the Gila River. Hazardous chemicals released included copper sulfate, copper tailings and leachate. 84 In addition, report found that multiple groundwater wells downgradient of the Mine were found to be slightly contaminated by copper and lead/hates solution which was attributed to releases of groundwater along Mineral Creek, and it concluded that "it is likely that hazardous substances present in the shallow groundwater will represent an ongoing concern of chronic contamination to the Mine." 85</p> <p>According to a report by the U.S. EPA, at least 5 spills of hazardous materials were reported at the Ray Mine from August 1998 through November 1998. 86 The majority of the spills were from tanks, pipelines, and ponds. These discharges typically resulted from either accidental discharges associated with heavy rainfall or from leakage from leaching facilities into the ground water, which then entered the creek. The report found that, "surface water quality has been significantly affected." A total of 10 spills of total copper, dissolved copper, and barium documented by the Arizona Department of Environmental Quality (ADEQ), EPA, and ASARCO in the Mine Creek below the Ray Mine. 87</p> <p>According to Robert, Arizona's Department of Game and Fish, stated that the discharges from the Ray Mine have negatively affected both the water quality and the aquatic life of the Mine Creek. The Department conducted a biological survey of Mine Creek in July 1998. In a report dated September 30, 1998, the Department found that although the numbers and diversity of the aquatic life were high above the Ray Mine, and almost complete absence of aquatic life was observed directly downstream of the Mine. 88</p>	
Water collection and treatment failures 89	According to an EPA report, "The mine's routine operations are chronically affecting the quality of surface and ground water in the vicinity." 90 According to the report, the Arizona Dept. of Environmental Quality reported in 1996 approximately one-half of Mineral Creek streambed below the Ray Mine was severely affected by mine activities. 91 The streambed was coated with a bright yellow of copper. 92 In 1998, EPA reported that six ground water wells situated downgradient of the



	<p>electrowinning plant and the electrowinning dam were continuously pumping PLS.⁸⁷ □ Multiple groundwater wells were found to be high in total dissolved solids and chloride solution which was attributed to the releases of ASARCO's shallow groundwater along Mineral Creek. It is concluded likely that the hazardous substance present in the shallow groundwater will represent an ongoing source of the chromate contamination to Mineral Creek (Lipton 2009).⁸⁸ □</p>
Tailing spills and impoundment failures	<p>2012: Seepage from the tailingsimpoundment was released into two catch basins and into a tributary of the River.⁸⁹ At the time of the report, seeing the tributary was estimated at 100%. □ 2011: A report from the USGS on the copper tailings released from the ASARCO tailings pond due to rainfall in the area.⁹⁰ □ In 1992, heavy precipitation caused the Gila River to overflow the AB tailing containment dike.⁹¹ According to the party in interest, continued flooding over the next several days resulted in the failure of three lateral branches of the tailings pile. The total discharge was approximately 290,000 tons of tailings which was about 216,000 cubic yards of material. It is believed that sampling of the river showed elevated concentrations of pollutants carried by the last downstream tailings for miles. The tailings formed banks and bottom deposits in the river, impairing both recreational uses and the quality of the habitat for fish and mammals.⁹² □ In 2009, the Department of Interior and the state of Arizona, as natural resource trustees (Trustees) received a monetary settlement and three parcels of land from ASARCO, LLC through the Natural Resource Damage Assessment and Restoration (NRDAR) program to account justly to the resources incurred through multiple releases of hazardous substances by the ASARCO into Mineral Creek and the Gila River in El Paso, Texas.⁹³ □ According to the ecological risk assessment by the state of Arizona, the site of injury stretches from the Hayden Diversion Dam, upstream past the confluence of the San Pedro and Gila Rivers, and for a distance of up to each of the miles beyond the confluence and to the Mineral Creek from its confluence with the Gila River upstream to approximately one mile above the Big Box Canyon Dam. The most substantial injuries occurred in the reach of the Mineral Creek that extends from the confluence to the Gila River. The report finds that "Dissolved copper concentrations at surface waters of the reach have been recorded up to 18 times surface water quality standards that will sustain aquatic life in the reach. Sediment copper concentrations have been recorded to exceed 22 times levels beyond which injury is inflicted to sediment dwelling organisms (MacDonald et al. 2000)." These concentrations of copper exceeded complete loss of aquatic life in this reach.⁹⁴ □ Overall, the report found that ecosystem services losses in the area include Mineral Creek and its associated riparian habitat which was estimated to be 100% from 1981 to 2005, and up to 50% from 2005 to the present (Lipton 2009). Hazardous releases also affected the aquatic and riparian portions of the River near the Ray Mine/Hayden Smelter Complex, including approximately 2,980 acres upstream of the Mineral Creek to the confluence with the San Pedro River, and approximately 1,620 acres downstream of the Mineral Creek to the Ashurst Diversion Dam. The most substantial losses of the ecosystem services in the area occurred during the three years following the release of over 300,000 tons of tailings in 1992. Ecosystem service losses were estimated at 10-125% (Lipton 2009)."⁹⁵ □</p>
Impacts to water, fish and wildlife	<p>*Limitations in data for spill lines and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spills. □</p>

*Limitations in data for spill lines and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spills. □



CHINO MINE, NM (Freeport-McMoRan)

The Chino Mine is located approximately 12 miles northeast of Silver City, New Mexico. The site is the east Continental divide and drains into deep ephemeral drainages in the Mimbres watershed.

Report of pipeline failures and other accidental releases*	<p>2007: A spill involving one million gallons of acidic wastewater flowed a short distance down a stream into a tributary near the mine. The spill resulted in overground groundwater contamination and settlement of \$276,000 reached with the State of New Mexico.⁹⁷</p> <p>Multiple other tailing spills have occurred, which are listed below:⁹⁸</p> <ul style="list-style-type: none"> 2000: Report of 180,000 gallons of tailings discharged, with 93,000 gallons entering Whitewater creek. 1999: Report of 1.25 million gallons of tailings into Whitewater Creek. 1997: Report of 100,000 gallons of tailings into Whitewater Creek. 1996: Report of 152,000 gallons of liquid gypsum into Whitewater Creek. 1993: Report of 208 tons and 1,800 gallons of tailings accidentally released to the Whitewater Creek in separate incidents resulting from rupture of degraded pipes. 1992: Report of 120,000 gallons of tailings into the basin. 1991: Report of 1,200 gallons of tailings dumped into Whitewater Creek when a tailings pipeline ruptured. 1988: Heavy rains led to the release of 180 million gallons of wastewater into Whitewater Creek over a 35-day period. Analysis of wastewater indicated that it had 30 times elevated levels of hazardous substance cadmium, as well as 30 times the allowed level of sulfates.⁹⁹ 1986: Report of 200 gallons of waters spilled.
Water collection and treatment failures	<p>In 2011, the Department of Justice State of New Mexico issued a consent decree forcing the mine to remove hazardous substances from the Chino, Tyone and Cobre mines.¹⁰⁰ The settlement followed an investigation of water resource injuries related to the release of hazardous substances into the environment from acid mine drainage and process solution, among others sources.</p> <p>It is found that surface water and associated sediments are exposed to hazardous substances released from the Chino Mine through a variety of pathways, including leaching and spills of process tailing spills; runoff, and infiltration or percolation of tailings and waste stockpiles.¹⁰¹</p> <p>It is also found that hazardous substances have been released into groundwater at the Chino mine from multiple source areas.¹⁰² Concentrations of hazardous substances in groundwater exceed or equal water quality standards confirm release to the groundwater throughout the Chino Mine. Groundwater flow modeling for the North Mine area indicates that contaminated groundwater in the subsurface is captured by the dewatering in the pit.</p> <p>In the Mine area, groundwater has exceeded standards for manganese and cadmium at the Mimbres River, Hondo and Lake Oñate, and has exceeded standards for copper at the Oñate.¹⁰³</p> <p>A 2012 assessment of groundwater facts concluded that contaminated seepage from the mine will require water treatment in perpetuity.¹⁰⁴</p>
Tailing spills	Tailing spills (see above).



and ☐ impoundment ☐ failures ☐	
Impacts to ☐ water, fish and ☐ wildlife ☐	<p>The 2008 ecological risk assessment reported elevated concentrations of ☐ substances compared to the surface water from five different drainages at the Chino Mine, including Hesperia/Whitewater Creek, Bayard Canyon, Boldon Draw, the unnamed drainage between Boldon Draw and Lampbright Draw, and Lampbright Draw.¹⁰⁵ ☐</p> <p>The area extent of the impacted regional groundwater at the Chino Mine is 13,935 acres.¹⁰⁶ ☐</p> <p>According to the report for the Chino Mine, contaminated groundwater will require ☐ water treatment in ☐ perpetuity.¹⁰⁷ ☐</p>

*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, ☐
in some cases, whether water quality impacts resulted from the spill. ☐



□ δ
BAGDAD MINE, AZ □ δ (Freeport-McMoRan) □ δ

The Bagdad Mine is an open pit copper and molybdenum complex 100 miles northwest of Phoenix, Arizona. □ δ

Report of pipeline failures and other accidental releases* □ δ	<p>2009: Report of tank pipeline causing a release of 20378 gallons of sulfuric acid. □ δ ¹⁰⁸</p> <p>2007: Report of 225 gallons of raffinate solution containing sulfuric acid spilled from a pond. □ δ ¹⁰⁹</p> <p>2004: Report of 7484 tons of sulfuric acid released due to the malfunction of a pipe. □ δ</p> <p>2004: Report of 1,054 tons of sulfuric acid released due to a crack in a pipe. □ δ ¹¹¹</p> <p>1999: Report of 12,000 tons of process water residual chlorine spilled into Bridle Creek. □ δ ¹¹²</p> <p>1997: Report of 1,500 tons of sulfuric acid spilled into a pipe. □ δ ¹¹³</p> <p>1997: Report of 7,200 tons of sulfuric acid overflowed from ponds due to a drain blockage. □ δ ¹¹⁴</p>
Water collection and treatment failures □ δ	<p>In 1994, EPA and the state of Arizona fined Cyprus Bagdad Copper Co., a subsidiary of Cyprus Mineral Corp., paid penalties totaling \$760,000 for discharging contaminated water from the Bagdad Copper Mine. □ δ ¹¹⁵ The discharges involved various facilities including tailings ponds, leach pads, and wastewater treatment plant, but they did far them. □ δ ¹¹⁶ Discharges came from the Copper Creek Leaching Basin, in the acidic, copper-tainted underground seepage entered Boulder Creek.</p> <p>According to EPA report, seepage of pregnant solution from the Copper Creek Leaching System was discovered in the receiving pond in Boulder Creek in 1991. □ δ ¹¹⁷ Studies indicated that instead of being gained by Copper Creek Flood Basin, the heavily contaminated solution seeped underneath it. The concentration of total dissolved samples collected in the basin in the Boulder Creek area was high during March 1993, U.S. EPA issued a Finding of Violation Order against Cyprus. □ δ ¹¹⁸</p> <p>According to 2006 study that compared the water quality predictions made during mine permitting with water quality impacts during operations, although no major water quality impacts were predicted during the permitting process, the following water quality violations occurred: Water quality monitoring (1998–2005) in the Boulder Creek and water quality exceedances for arsenic, lead, mercury, and selenium. □ δ In Iron Creek, there were water quality exceedances for copper and mercury. In the Butte Creek, there were water quality exceedances for mercury and selenium. □ δ ¹¹⁹</p>
Impacts to water, fish and wildlife □ δ	<p>Copper and low pH releases to groundwater, surface waters, hazardous to the aquifer from solution releases beneath and over containment system dams. Water quality impacts to the Boulder Creek, Butte Creek and Butte Creek. □ δ</p>

*Limitations in data from pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill. □ δ □ δ



□ δ

SIERRITAMINE, AZ □ δ (FreeportMorrison) □ δ

The Sierrita Mine is an open pit copper and molybdenum mining complex 20 miles southwest of Tucson, Arizona. □ δ

□ δ

Report of pipeline failures and other accidental releases* □ δ	<p>2011: Report of approximately 300 pounds of sulfuric acid spilled from a broken pipeline. □ δ ¹²⁰ □ δ</p> <p>2008: Report of approximately 1,000 pounds of sodium hydroxide spilled due to a pipe leak. □ δ ¹²¹ □ δ</p> <p>2005: Report of approximately 1,000 pounds of sulfuric acid spilled from a broken pipeline. ¹²² □ δ</p> <p>2005: Report of approximately 8,000 pounds of sulfuric acid released from a broken pipeline. ¹²³ □ δ</p> <p>2002: Report of approximately 39,375 pounds of sulfuric acid spilled from a pipeline from a separated flange. ¹²⁴ □ δ</p> <p>2001: Report of approximately 1,200 pounds of sulfuric acid spilled from a pipeline. ¹²⁵ □ δ</p> <p>2000: Report of approximately 5,000 pounds of sulfuric acid leaked from a pipe. ¹²⁶ □ δ</p> <p>1998: Report of approximately 10,000 gallons of sulfuric acid spilled into a water ditch due to overfilling from a power failure. ¹²⁷ □ δ</p> <p>1998: Report of approximately 40,000 pounds of sulfuric acid solution spilled from a pipeline. ¹²⁸ □ δ</p> <p>1998: Report of approximately 120,000 pounds of sulfuric acid solution spilled from a pipeline. ¹²⁹ □ δ</p> <p>1997: Report of approximately 98 pounds of sulfuric acid spilled due to a pipeline rupture. ¹³⁰ □ δ</p> <p>1997: Report of approximately 200 pounds of sulfuric acid due to a pipe failure. ¹³¹ □ δ</p> <p>1996: Report of approximately 200 gallons of sulfuric acid due to a pipe failure. ¹³² □ δ</p> <p>1994: Report of another pipeline break allowed a large discharge of Demetrie Wash of approximately 120,000 gallons of raw water. ¹³³ □ δ</p> <p>1994: Report of approximately 5,000 gallons of reclaimed water were released as a result of a pipe break. ¹³⁴ □ δ</p> <p>1993: Report of a leak in the pipeline during a leaching process where water discharged approximately 200,000 gallons of contaminated water into a stream running off of an unnamed tributary of Demetrie Wash. ¹³⁵ □ δ</p> <p>1993: Report of approximately 2,700,000 gallons of water discharged into a wash as a result of another pipeline break. ¹³⁶ □ δ</p> <p>1993: Report of approximately 450,000 gallons released to a ditch in October by a broken pipeline. ¹³⁷ □ δ</p>
Water collection and treatment failures □ δ	<p>From the summer of 1992 December 1994, Sierrita discharged contaminated process water and stormwater runoff into the Demetrie Wash and its tributaries from various overflows, see pages, and pipeline leaks and breaks. ¹³⁸ □ δ</p> <p>On May 25, 1995, the U.S. Department of Justice issued a complaint against Cyprus □ δ Sierrita on behalf of the State of Arizona and the United States pursuant to the Clean Water Act. ¹³⁹ Cyprus Sierrita entered into a binding Consent Decree to pay total fine of \$88,000 for various violations. □ δ</p> <p>According to 2011 report, see page from an unlinked document at the Phoenix's □ δ Sierrita mine has sent a plume of contaminating wastewater toward the city of Green Valley, causing drinking water wells to record high levels of sulfate. In 2006, the company signed a mitigation order to convert the state of Arizona addressed in the drinking water. □ δ The requires company to develop mitigation plan submitted in 2009. □ δ</p>



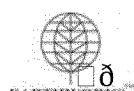
Impacts to water, fish and wildlife

Groundwater and surface water contamination have occurred from pipeline leaks and breaks, overflows, and underground seepage from process wastewater, wastewater, and stormwater surface impoundments. Drinking water wells have been affected.

*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill.



<p style="text-align: center;">PINTO VALLEY MINE, AZ ☐ ☐ ☐ (BHP) ☐ ☐</p> <p>The Pinto Valley Mine is ☐ ☐ ☐ open pit ☐ copper and gold mine located about 126 km ☐ ☐ east of Phoenix, ☐ ☐ ☐ Formerly owned by ☐ ☐ ☐ Mag copper Company . ☐ ☐ ☐</p>	
☐ ☐ ☐	
Reportsof ☐ ☐ pipeline ☐ ☐ failures and ☐ ☐ other ☐ ☐ accidental ☐ ☐ releases ☐ ☐	<p>2010: Report of ☐ storm event, which caused 5,362 tons of ☐ ☐ ☐ tailings ☐ ☐ ☐ spilled into ☐ ☐ ☐ Pinto Creek, including 214 pounds of ☐ ☐ ☐ arsenic 1100 pounds ☐ ☐ ☐ lead. ¹⁴¹ 500 cubic yards ☐ ☐ were released into water. Pinto Creek is ☐ ☐ ☐ a tributary to ☐ ☐ ☐ Roosevelt. ☐ ☐ ☐ ☐</p> <p>2010: Report of ☐ ☐ ☐ a ☐ unknown amount of ☐ ☐ ☐ tailings ☐ ☐ ☐ released onto land, with a ☐ ☐ ☐ potential release to ☐ ☐ ☐ water, due to ☐ ☐ ☐ heavy rain. ¹⁴² ☐ ☐ ☐</p> <p>2001: Report of ☐ ☐ ☐ 25 pounds of ☐ ☐ ☐ sulfur released due to ☐ ☐ ☐ pipeline break. ¹⁴³ ☐ ☐ ☐</p>
Water ☐ ☐ collectionand ☐ ☐ treatment ☐ ☐ failures ☐ ☐	<p>According to ☐ ☐ ☐ EPA report, a ☐ ☐ ☐ portion of ☐ ☐ ☐ Rintek from its headwaters to ☐ ☐ ☐ Spring Creek was first listed as ☐ ☐ ☐ waterbody listed in ☐ ☐ ☐ 1990 and ☐ ☐ ☐ elevated concentrations and ☐ ☐ ☐ values were related to ☐ ☐ ☐ discharges from Pinto Valley and ☐ ☐ ☐ another mine. ☐ ☐ ☐ The main portions of ☐ ☐ ☐ stream were added to ☐ ☐ ☐ CERES (C) list in ☐ ☐ ☐ 1994. ¹⁴⁴ ☐ ☐ ☐</p> <p>The report further states that, "Since 1989, extreme storms caused releases of ☐ ☐ ☐ copper bearing sediments and liquid to ☐ ☐ ☐ Rintek from Pinto Valley operations. These ☐ ☐ ☐ releases resulted from partial tailings dam failures, pipeline breaks, seepage flows, ☐ ☐ ☐ conveyance blockages, and stormwater overflows. Recent significant release events ☐ ☐ ☐ occurred in ☐ ☐ ☐ August 1989, July 1990, January 1991, August to ☐ ☐ ☐ September 1991, January to ☐ ☐ ☐ February 1993, and October 1997. In ☐ ☐ ☐ each of these events, materials were released in ☐ ☐ ☐ quantities sufficient to ☐ ☐ ☐ impact Pinto Creek on ☐ ☐ ☐ miles. ¹⁴⁵ ☐ ☐ ☐</p> <p>Based on ☐ ☐ ☐ EPA's ☐ ☐ ☐ discharge monitoring reports between January 1 ☐ ☐ ☐ 990 and ☐ ☐ ☐ September 1991, Magma (now ☐ ☐ ☐ Rintek) reportedly discharged effluent to ☐ ☐ ☐ Rintek ☐ ☐ ☐ or ☐ ☐ ☐ total stations in ☐ ☐ ☐ excess of allowable effluent limitations on ☐ ☐ ☐ numerous occasions, and/or ☐ ☐ did not collect and analyze samples, in ☐ ☐ ☐ violation of ☐ ☐ ☐ permit conditions. ¹⁴⁶ ☐ ☐ ☐</p> <p>According to ☐ ☐ ☐ expert, ☐ ☐ ☐ during the first episode, approximately 3,000 gallons of ☐ ☐ ☐ effluent ☐ containing total suspended solids and ☐ ☐ ☐ copper of ☐ ☐ ☐ unknown concentrations was discharged from the site. A ☐ ☐ ☐ similar charge of ☐ ☐ ☐ 24 gallons occurred on ☐ ☐ ☐ September 1991 ☐ ☐ ☐ estimated 39,000 gallons of ☐ ☐ ☐ effluent exceeded surface Water Quality ☐ ☐ Standards and Aquifer Water Quality Standards for copper, zinc, and lead were discharged from the site on ☐ ☐ ☐ September 28, 1991. ¹⁴⁷ ☐ ☐ ☐</p>
Tailingsspills ☐ ☐ or ☐ ☐ ☐ failures ☐ ☐	<p>In ☐ ☐ ☐ 1997, ☐ ☐ ☐ tailings failure deposited an ☐ ☐ ☐ estimated 276,000 cubic yards of ☐ ☐ ☐ tailings into ☐ ☐ ☐ Pinto Creek. ¹⁴⁸ It ☐ ☐ ☐ buried roads, ☐ ☐ ☐ creekbeds and surrounding upland with material as ☐ ☐ ☐ deep as ☐ ☐ ☐ feet. ¹⁴⁹ ☐ ☐ ☐</p> <p>Another incident occurred in ☐ ☐ ☐ 1992, heavy rainfall overwhelmed the mine's water management capabilities. During the initial fall event, a ☐ ☐ ☐ reservoir overflowed the tailings pile, tore out the leach pond and caused tailings to ☐ ☐ ☐ Rintek. ¹⁵⁰ In ☐ ☐ ☐ addition, ☐ ☐ ☐ reported that the water and mineral wastes discharged material into the creek after its dam was breached. According to ☐ ☐ ☐ EPA report of ☐ ☐ ☐ incident "Critical water containment structures failed at the site in ☐ ☐ ☐ 1992 reportedly designed to ☐ ☐ ☐ hold 100 years of ☐ ☐ ☐ hour stormwater. Nonetheless, the mine discharged hundreds of ☐ ☐ ☐ tons of ☐ ☐ ☐ tailings ☐ ☐ millions of ☐ ☐ ☐ gallons of ☐ ☐ ☐ contaminated water into Pinto Creek." ¹⁵¹ Water quality sampling ☐ during January and February 1993 indicated 28 exceedances of ☐ ☐ ☐ daily monthly water quality parameters. Fish surveys collected before and after the discharges showed a ☐ ☐ ☐ marked decline in ☐ ☐ ☐ populations of ☐ ☐ ☐ desert sucker (☐ ☐ ☐ ☐ Pantosteus clarkii) ☐ ☐ ☐ following ☐ ☐ ☐ discharges. Although they were abundant in ☐ ☐ ☐ 1992, fish surveys in ☐ ☐ ☐ 1993 ☐ ☐ ☐ only one adult in ☐ ☐ ☐ Rintek. ¹⁵² ☐ ☐ ☐</p> <p>In ☐ ☐ ☐ January 1991, the face of ☐ ☐ ☐ Tailings dam ☐ ☐ ☐ No. 2 failed causing 150 ☐ ☐ ☐ 250 tons of ☐ ☐ ☐ tailings</p>



	<p>into Pinto Creek, containing 100,000 gallons of the water.¹⁵³ This In May 1991, another large quantity of tailings released from the sandpile¹⁵⁴ This release occurred from an overburden of tailings facets heavy rain precipitation, and an estimated 140,000 gallons of water were discharged.</p>
Impacts to water, fish and wildlife	Extensive impacts to surface water quality and fish habitat resulting from tailings spills, and other mineral related impacts.

*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spills.



MISSIONCOMPLEXMINE, AZ ð ð (ASARCO) ð

The Mission Mine complex is open pit copper mine and underground copper mine located near Sahuarita, Arizona (18 miles south of Tucson). The Mine covers approximately 29 square miles and is positioned in the eastern piedmont hills.

Reportsof pipeline failures an other accidental releases* □	<p>2011: Report of a backup of tailings lines resulting in a release of tailings into the Columbia River. ¹⁵⁵</p> <p>2002: A violation involving the discharge of a primary effluent stream water runoff from the process wastewater discharge to the ephemeral tailings of the Asha Creek near Tucson in violation of facilities Multi Sector General Permit Case #02-02-0054G.</p> <p>2001: Report of a dry tailings distribution tailings line releasing 200 tons of tailings into dry stream channel. ¹⁵⁶</p>
Water collectionand treatment failures □	<p>According to a news release released in 2008, discharges from mine outfalls (outfall 001A) contain significant levels of copper lead and TSS which have been out of compliance since October, 2008. Outfalls from the Mission complex discharge to the ephemeral streams that are tributaries to the Asha Creek River.</p>
Tailingsspills or impoundment failures □	<p>Three large tailings ponds and several smaller ponds are dumped onto Indian landowners approximately 10 miles south of Athabasca project area. According to a report by the Bureau of Reclamation each late from the tailings has contributed to the elevated levels of sulfates, hardness in the surface water and adjacent to the ponds. ¹⁵⁸</p>
Impacts to water,fishand wildlife □	<p>The Bureau of Reclamation states that, "Surface drainage from a break in a tailings pond dike in 1990 caused large volumes of material wash complexes that drained toward the SCA." ¹⁵⁹</p>

*Limitations in the data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality is impacted from the spill or not.



<p style="text-align: center;">□ δ</p> <p>ROBINSON MINE, NV δ (Robinson Nevada Mining Co.) δ Formerly owned by δ Copper, Magma Nevada Mining Company δ</p> <p>The Robinson Mine is δ open pit copper and gold mine located in δ east Nevada δ δ approximate δ 11δ δ west of δ Nevada δ δ</p> <p style="text-align: center;">□ δ</p>	
Reportso δ pipeline δ failures and δ other δ accidental δ releases* δ	1996: The mine experienced eight reported spills during 1996. Most of δ the spills δ involved tailings solution and/or claim waste δ ter releases due δ to δ equipment failures δ five δ spills resulting in δ releases δ up to δ tailings spills volumes ranging from 1,500 δ gallons to δ 66,000 tons. δ One spill resulted in δ contamination of δ areas of δ the largest spills resulted in δ contamination of δ downstream of δ 2.3 miles with an δ average rate of δ width of δ 100 feet. δ Another spill resulted in δ a combined release of δ 76,000 tons δ red water. δ ¹⁶⁰
Water δ collection and δ treatment δ failure δ δ	In δ 2010, state of δ Nevada issued δ Finding δ Allegation and Order for Remedial Action δ to δ comply with δ regulatory requirements regarding stabilization of δ spent δ acid associated with rock drainage at δ the Green Springs area. ¹⁶¹ The Order δ requires the mine to δ "submit a plan by May δ 010 stating whether the Mill δ Water δ Ponds, the head stack pipe near the Mill δ Water Ponds, and any δ other leaking pipes δ or δ tanks at the will remain on δ Liberty Dump or δ removed from δ Liberty Dump δ (and any δ other potential sources). If δ the Mill δ Water Ponds will remain on δ Liberty δ Dump, specify whether they will be δ replaced, δ tested, repaired to δ demonstrate δ integrity of δ primary and secondary liners. If δ tanks will be δ tested, repaired to δ demonstrate integrity, include a δ complete description of δ proposed methods to δ be δ used for δ Pre-review and approval." δ
Tailingss δ and δ impoundment δ failures δ δ	Tailingss δ (see above) δ
Impacts to δ water, fish and δ wildlife δ δ	Contamination of δ downstream of δ 13 miles from δ mine tailings process δ water. (See above) δ

*Limitations in δ data for pipeline spills and other accidental releases make it δ difficult to determine, δ some δ cases, whether water quality impacts resulted from the spills. δ δ



<p style="text-align: center;">□ δ</p> <p style="text-align: center;">TYRONE MINE, NM □ δ (Freeport-McMoRan) □ δ</p> <p>The Tyrone Mine is located approximately 10 miles west of the City of Silver City, New Mexico. □ δ The mine straddles the Continental Divide. □ δ</p> <p style="text-align: center;">□ δ</p>	
Report of pipeline failures and other accidental releases* □ δ	<p>2006: Report of spill occurring when a tank truck loaded with acid ruptured at the 3-gallons-per-second of acid leaked from a pickup truck, spilling about 500 gallons of acid onto the highway and adjacent property. ¹⁶² (non-pipeline) □ δ</p> <p>2003: Report of approximately 2,600 gallons of 16% aromatic solution spilled at the Tyrone mine during maintenance activity on the pipeline system. ¹⁶³ □ δ</p> <p>2001: Report of 500-1000 gallons of solution leaked from the pipeline. ¹⁶⁴ □ δ</p> <p>2001: Report of 200 gallons spilled from the 5# pond, which overflowed with 7500 gallons entering Deadman Canyon. See page 16 of part II. Deadman Canyon was flowing at approximately 50 gpm. ¹⁶⁵ □ δ</p> <p>1997: Report of 65,000 gallons of raffinate leaked from a ruptured weld in the mainline pipeline. ¹⁶⁶ □ δ</p> <p>1997: Report of transfer line rupture due to weld failure □ δ</p> <p>1994: Report of over 2,000 gallons from two broken pipes detected in groundwater. □ δ</p> <p>2012 report identifies diesel fuel contaminant concentrations in groundwater at the leak in the distribution line at the fuel tank farm, which migrated to the region. ¹⁶⁷ □ δ</p> <p>2012 report identifies diesel fuel contaminant concentrations in groundwater at the leak in the distribution line at the fuel tank farm, which migrated to the region. ¹⁶⁸ □ δ</p>
Water collection and treatment failures □ δ	<p>In 2011, the Department of Justice State of New Mexico issued a consent decree forbidding releases to the natural resources from hazardous substances from the Tyrone, Chino, and Cobre mines. ¹⁶⁹ □ δ</p> <p>These elements followed an investigation of natural resource injuries related to the release of hazardous substances into the environment from acid mine drainage and process solution, among other sources. ¹⁷⁰ According to the stipulation, "groundwater in both the regional aquifer and the perched groundwater aquifers has been exposed to hazardous substances through a variety of pathways." ¹⁷¹ The assessment at the Tyrone Mine identified 14 different areas where it affected water quality, including seepage from tailingsimpoundments, leach stockpiles and wastewater stockpiles. □ δ</p> <p>A 2012 groundwater assessment concluded that contaminated seepage from the mine will require water treatment in perpetuity. ¹⁷² □ δ</p>
Tailings spills and impoundment failures □ δ	<p>There have been multiple spills of tailings containing hazardous substances. □ δ</p> <p>The largest event occurred at the tailings in 1980,ing 206 million cubic yards of tailings into the Magdalena Valley. ¹⁷³ Tailings flowed 8 kilometers downstream and inundated farmland. ¹⁷⁴ The failure occurred due to dam wall breach. □ δ □ δ</p> <p>2001: 500 tons of tailings spilled into the Magdalena Wash from the stormwater containment dike at the tailings dam. ¹⁷⁵ □ δ</p> <p>1990: Minor tailings spills from the No. 2 tailings pond in Jan 1990, and similar minor spills from the No. 2 tailings during 1990. ¹⁷⁶ □ δ</p>
Impacts to water, fish and wildlife □ δ	<p>Streams and washes in vicinity of the mine facility are ephemeral – they flow only after significant precipitation events. □ δ</p> <p>According to the 2003 preliminary assessment, "Surface water is exposed to hazardous substances released from the Tyrone Mine through a variety of pathways. Magdalena, □ δ</p>



an ~~ephemeral~~^{stream} adjacent to the Mine, which becomes perennial at Mangas Springs and has been exposed to the hazard substances through spills and potentially through runoff from another location.”¹⁷⁷

The area extent of contaminated groundwater plume at the Mine is about 6,280 acres.¹⁷⁸ Groundwater seepage will require water treatment in order to be perpetual.

*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill.



□ δ
MIAMI MINE, AZ □ δ

(Freeport McMoRan; formerly owned by Phelps Dodge and Cyprus Amax Minerals) □ δ

The Miami Mine is an open pit mine located 90 miles south of Phoenix, Arizona. □ δ

□ δ

Report of pipeline failures and other accidental releases* □ δ	<p>2011: Report of 600 pounds of lead sulfide spilled from pipeline into the Colorado River due to faulty valves. □ δ¹⁷⁹ □ δ</p> <p>2009: Report of 1,600 pounds of lead sulfide spilled due to pipeline break. □ δ¹⁸⁰ □ δ</p> <p>2007: Report of release of 3,450 pounds of lead sulfide from pipeline. □ δ¹⁸¹ □ δ</p> <p>2001: Report of releases of 3,953 pounds and 6,400 pounds respectively of lead arsenic from pipeline. □ δ¹⁸² □ δ</p> <p>2001: Report of release of 3,070 pounds of lead from pipeline blowdown. □ δ¹⁸³ □ δ</p> <p>1997: Report of 10,000 gallons of copperated water overflow tank. □ δ¹⁸⁴ □ δ</p> <p>1996: Report of 50,000 gallons of sulfuric acid tank rupture. □ δ¹⁸⁵ □ δ</p> <p>1996: Report of 8,095 pounds of sulfuric acid leak. □ δ¹⁸⁶ □ δ</p>
Water collection and treatment failures □ δ	<p>The Pinail Creek drainage was designated a Water Quality Assurance Revolving Fund (WQARF) site by the Arizona Department of Environmental Quality in 1989 due to acid and metals contamination in the alluvial aquifer. The WQARF program is the state equivalent of the federal "superfund" program. The Miami Mine, inherited from the Cyprus Miami Mine (formerly the Inspiration Mine) is a member of the Pinail Creek Water Quality Assurance Revolving Fund (WQARF) Site. □ δ¹⁸⁷ □ δ</p> <p>The Pinail Creek site was listed under the Arizona Water Quality Assurance Revolving Fund program in 1989 for contamination in the alluvium via leaching in the Pinail Creek drainage near Miami, Arizona. □ δ¹⁸⁸ □ δ</p>
Impacts to water, fish and wildlife □ δ	<p>The Water Quality Assurance Revolving Fund (WQARF) program is the state equivalent of the Federal "superfund" program. The Miami Mine, inherited from the Cyprus Miami Mine (formerly the Inspiration Mine) is a member of the Pinail Creek Water Quality Assurance Revolving Fund (WQARF) Site. □ δ¹⁸⁹ □ δ</p> <p>The Pinail Creek drainage was designated a WQARF site by ADEQ in 1989 due to acid and metals contamination in the alluvial aquifer. □ δ¹⁹⁰ □ δ</p>

*Limitations in data for pipelines and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the pipeline. □ δ □ δ



□ δ
SILVER BELT MINE, AZ □ δ (ASARCO) □ δ

The Silver Belt Mine is an open pit copper mine located on the other edge of the Silver Belt Mountains. □ δ

Report of pipeline failures and other accidental releases* □ δ	<p>2010: Report of 1,083 pounds of sulfur released due to a pipe failure. □ δ¹⁹¹</p> <p>2006: Report of 20,000 gallon release of raffinate mother liquor after sulfuric acid and various metals. The release was due to equipment failure at a mining pipeline. □ δ¹⁹²</p> <p>2002: Report of 242 pounds of process water 130 pounds of sulfur spilled due to a pipe break in the flow of sulfur solution. □ δ¹⁹³</p>
Water collection and treatment failures □ δ	<p>In 2002, EPA fined \$10,000 for three spills totaling 340,000 gallons of wastewater containing sulfuric acid and heavy metals into dry washes. □ δ¹⁹⁴ The pollutants seeped into soil which endangered groundwater in the area below the mine and exceeded water quality standards. Two of the spills are described as between Nov. 6 and Dec. 11, 2006, 150,000 gallons of leachate containing sulfuric acid and metals escaped from a leaking embankment. And between Nov. 11 and Dec. 13, 2006 another 100,000 gallons of stormwater containing sulfuric acid and heavy metals escaped from a storage pit. □ δ</p> <p>According to EPA report, during site inspections of the mine in January 1993, the Arizona Department of Environmental Quality (ADEQ) observed water flowing in three unnamed washes below Silver Belt Mine. □ δ¹⁹⁵ Samples taken from the washes flowing under the waste rock dump showed violations of standards for selenium, which flows from the waste rock dump, showed a broad range of exceedances, concentrations of copper ranging several orders of magnitude than the concentrations in the stream. Analysis showed violations of standards for pH, total zinc, total cadmium, and dissolved copper. □ δ</p>
Tailing spills and impoundment failures □ δ	Tailing spills (See below). □ δ
Impacts to water, fish and wildlife □ δ	<p>According to 2000 report on the native fish population in Coconino County, the loss of the native fish habitat in the Colorado Wash is just one example of the detrimental damaging effects that mining can have on the aquatic systems. Summer floods in July August 1981 swept gravel clay sediments from the Silver Belt tailings pond into the wash. BLM biologist Bill Cepher later reported, "Quench studies indicate that the Colorado Wash trout population is now extinct in the habitat due to recurrent spills and foundations by tailings. □ δ (Fonseca, 2000)." □ δ¹⁹⁶</p>

*Limitations in data for pipeline spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from the spill. □ δ □ δ



□ δ
MINERAL PARK MINE, AZ (Mercator) □ δ

Mineral Park is an open pit copper mine in the Colorado Mountains near Kingman, AZ □ δ

□ δ

Report of pipeline spills and other accidental releases* □ δ	<p>1996: Report of 150 gallons of sulfuric acid released from a acid storage tank due to equipment failure. ¹⁹⁷ □ δ</p> <p>1996: Report of 200 tons of sulfuric acid released. ¹⁹⁸ □ δ</p> <p>1996: Report of 100 tons of sulfuric acid spilled. ¹⁹⁹ □ δ</p>
Water collection and treatment failures □ δ	<p>According to 1995 report by Arizona Geological Survey, water quality samples were taken of streamflow below the Mineral Park Mine and of winter seepage through a dam southwest end of tailings. ²⁰⁰ □ δ samples showed extremely low pH values (3.2, 2.6), extremely high TDS values (5,549 and 6,625 mg/L) and extremely high sulfate contents (4,500 and 6,000 mg/L). According to the report, cadmium concentration of streamflow just downstream of the Mineral Park Mine plume is 75 times higher than the standard, copper exceeds the standard 510 times in the 17.2 miles. It further states, "The discharge from the tailings ran down the washes until about two years ago when the tailings area and the tailings was buried. Years with very heavy rains the water could eventually reach the Colorado Wash." ²⁰¹ □ δ</p> <p>According to 1999 EPA report, the Mineral Park Mine collected surface water samples from seven drainages and analyzed them for metals and radioactive materials. ²⁰² All of these drainages, except for Golden Eagle Spring, exceeded either the Federal Maximum Contaminant Levels (MCLs) and/or state guidelines for gross alpha or gross beta. According to the report, ADEQ observed that surface water runoff emanating from the drainages in the area were affecting the water quality of the Colorado River. Data showed that the water contained high levels of beryllium, fluoride, boride and radon. Therefore it further stated that, "the data show that NORM is discharging abandoned mine drainage into the Colorado River impacting surface water and that mining operations have impacted groundwater." ²⁰³ □ δ</p> <p>A technical feasibility report commissioned by the company also describes a plume of contaminated water migrating down gradient from the mine. ²⁰⁴ □ δ</p>
Impacts to water, fish and wildlife □ δ	See above. □ δ

*Limitations in data for pipeline spills and other accidental releases make it difficult to determine if the mine, in some cases, whether water quality impacts resulted from the spill. □ δ □ δ



CONTINENTAL PIT MINE, MT □ Ø (Mon Resources) □ Ø

The Continental Pit □ Ø immediately adjacent to the Berkeley Pit □ Ø in Butte, and was initially known as the East Berkeley Pit. The Berkeley Pit and Continental Pit are included within the boundaries of the Silver Bow Creek/Butte Area Superfund site which was established in 1983. Mining in the Berkeley Pit was discontinued in 1982, but the Berkeley Pit (and the Continental pit) by 1983 was remediated in the Continental Pit by the Mon Resources in the 1986.²⁰⁵ Because of the proximity, management of the water mine waste at the mine sites are closely intertwined. □ Ø

Reports of pipeline spills and other accidental releases* □ Ø	<p>On January 28, 2009, □ Ø incident reported to the Department involving a broken tailings line which crevasses were doing maintenance. The cause was attributed to tailings in the line that was plugged with ice from the tailings pile. The water was shut off within five minutes and no water left the tailings pile reaching waters.²⁰⁶ □ Ø</p> <p>1992: Department records show a 1992 accident release of 1 million gallons in August 1992.²⁰⁷ □ Ø</p>
Water collection and treatment failures □ Ø	<p>According to 1993 report, the sources of groundwater contamination include the Butte Mine Flooding Operable Unit of the Superfund Site □ Ø were identified as: the underground workings; the walls of the Berkeley and Continental Pits; mine water in the underground workings; water rods and tailings piles near the Berkeley Pit leaving solutions from the leach pads and the Weed/MR Concentrator areas; leaving solutions from the Yankee Doodle Tailings Pond; contaminated soils and alluvium, and sulfuric acid added to the underground mines for copper leaching. Sources of water containing hazardous substances include: 1) process solutions from the historic Weed Concentrator and the current MR Concentrator.²⁰⁸ □ Ø</p> <p>Montana Resources suspended mining in the Continental Pit in 2000 due to the rising electricity costs.²⁰⁹ During that time, about 750 million gallons of water, averaging 6 million gallons per day, went into the Berkeley Pit and became mixed with the highly acidic pitwater already there. Montana Resources also diverted water from the Continental Pit into the Berkeley Pit for containment during their suspension. This contributed to the increased water levels in the Berkeley Pit which triggered the need to develop water treatment plants to the contaminated water from the pit which was rising to a critical level where contaminated pitwater becomes an additional source of contamination to the aquifer and Silver Bow Creek. Under a consent decree with the State of Montana and the Department of Justice's treatment plant was constructed and the mining companies are obligated to continue water treatment in perpetuity to the prevention of groundwater contamination.²¹⁰ □ Ø</p> <p>Minetailings from the Continental Pit are deposited in the Yankee Doodle tailings impoundment, which also contains the mine waste from previous mining in the Berkeley Pit. □ Ø the impoundment is unlined, leakage from the impoundment travels through faults and fractures into the Berkeley Pit. When mining ceases, seepage from the tailings impoundment will continue to contribute contaminated water to the Berkeley pit. As needed, a concrete cap requires contaminated water from the Berkeley Pit to be collected and treated in perpetuity.²¹¹ □ Ø</p>
Impacts to water, fish and wildlife □ Ø	<p>In addition to ground water issues described above, the following surface water impacts have also occurred: Silver Bow Creek is the stream drainage within the Butte Mine Flooding portion of the Superfund site. Historically, Silver Bow Creek began at the Continental Divide and flowed through the area that is now the Berkeley Pit in the Montana Resources (MR) permitted mine area. Mining activity has completely eliminated this uppermost reach of the Silver Creek. The creek now originates at thefluence of the</p>



	<p>Blacktail Creek and the Metro Stream Drain at the base of the Butte Hill²¹¹ Surface water flow above the tailings pond is intercepted during the mining process. From the tailings pond to the MR Concentrator original Silver and Bow Creek channel no longer exists. Surface water in active mining areas is controlled by series of four ditches ponds which carry runoff from the process waste to various locations, including the Berkeley Pit beach pads, and concentrator area (Figure 2). From the MR Concentrator to the fence with Blacktail Creek, the former creek has been reconfigured and is known as Metro Stream Drain.²¹²</p>
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*Limitations in data for pipelines spills and other accidental releases make it difficult to determine, in some cases, whether water quality impacts resulted from spills.

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